DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
2170 SW Canal Street
Stuart, FL 34997

REPLY TO
ATTENTION OF

25 March 2008

Regulatory Division
Special Projects and Enforcement Branch
SAJ-2008-134(NW-AAZ)

South Florida Water Management District
Attn: Carol Wehle
3301 Gun Club Road
West Palm Beach, FL 33416

Dear Ms. Wehle:

Your application for a Department of the Army permit received on January 15, 2008, has been assigned number SAJ-2008-134(NW-AAZ). A review of the information and drawings provided shows the proposed work is for the testing of a tilling technique on a 40-acre parcel at Indian Prairie in Lake Okeechobee. Two muck-tilling methods (plowing or muck flipping and disking or muck blending) would be tested at two separate depths: shallow plowing (1 foot depths), deep plowing (2 foot depths), shallow disking (1 foot depth), and deep disking (2 foot depths). Eight plots of equal size will be tilled within the 40-acre parcel. This 40-acre test project is the Phase 1 of a 3-phase project depending on the results. The purpose of the project is to restore ecological habitat within Lake Okeechobee. The 40-acre parcel is located in the Lake's near-shore littoral zone at Indian Prairie along the northwestern portion of the Lake. The project is located in Sections 31 and 32, Township 39 South, Range 34 East, Glades County, Florida.

Your project, as depicted on the enclosed drawings, is authorized by Nationwide Permit (NWP) Number 27. In addition, project specific conditions have been enclosed. This verification is valid until **25 March 2010**. Please access the U.S. Army Corps of Engineers' Jacksonville District's Regulatory web address at http://www.saj.usace.army.mil/regulatory/permitting/nwp/nwp.htm to access web links to view the Final Nationwide Permits, Federal Register Vol. 72, dated March 12, 2007, the Corrections to the Final Nationwide Permits, Federal Register 72, May 8, 2007, and the List of Regional Conditions. These files contain the description of the Nationwide Permit authorization, the Nationwide Permit general conditions, and the regional

conditions, which apply specifically to this verification for NWP 27. Additionally, enclosed is a list of the six General Conditions, which apply to all Department of the Army authorizations. You must comply with all of the special and general conditions and any project specific condition of this authorization or you may be subject to enforcement action. In the event you have not completed construction of your project within the specified time limit, a separate application or re-verification may be required.

The following special conditions are included with this verification:

1. Within 60 days of completion of the authorized work or at the expiration of the construction window of this permit, whichever occurs first, the Permittee shall submit as-built drawings of the authorized work and a completed As-Built Certification Form (Attachment 1) to the Corps. The drawings shall be signed and sealed by a registered professional engineer and include the following:

(a) A plan view drawing of the location of the authorized work footprint (as shown on the permit drawings) with an overlay of the work as constructed in the same scale as the attached permit drawings (8½-inch by 11-inch). The drawing should show all "earth disturbance," including wetland impacts, water management structures, and any on-site mitigation areas.

(b) List any deviations between the work authorized by this permit and the work as constructed. In the event that the completed work deviates, in any manner, from the authorized work, describe on the As-Built Certification Form the deviations between the work authorized by this permit and the work as constructed. Clearly indicate on the as-built drawings any deviations that have been listed. Please note that the depiction and/or description of any deviations on the drawings and/or As-Built Certification Form does not constitute approval of any deviations by the U.S. Army Corps of Engineers.

(c) The Department of the Army Permit number.

(d) Include pre- and post-construction aerial photographs of the project site, if available.

2. The Permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structures or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the Permittee will be required, upon due notice from the U.S. Army Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

3. No structure or work shall adversely affect or disturb properties listed in the National Register of Historic Places or those eligible for inclusion in the National Register. Prior to the start of work, the Permittee or other party on the Permittee's behalf, shall conduct a search in the National Register Information System (NRIS). Information can be found at; http://www.cr.nps.gov/nr/research/nris.htm. Information on properties eligible for inclusion in the National Register can be identified by contacting the Florida Master File Office by email at fmsfile@dos.state.fl.us or by telephone at 850-245-6440.

If unexpected cultural resources are encountered at any time within the project area that was not the subject of a previous cultural resource assessment survey, work should cease in the immediate vicinity of such discoveries. The permittee, or other party, should notify the SHPO immediately, as well as the appropriate Army Corps of Engineers office. After such notifications, project activities should not resume without verbal and/or written authorization from the SHPO.

If unmarked human remains are encountered, all work shall stop immediately, and the proper authorities notified in accordance with Section 872.05, Florida Statutes, unless on Federal lands. After such notifications, project activities on non-Federal lands shall not resume without verbal and/or written authorization from the Florida State Archaeologist for finds under his or her jurisdiction.

4. The permittee shall conduct a reconnaissance survey utilizing a metal detector as well as a shovel test prior to tilling. For areas that may contain canoes, an airboat survey will be implemented. Following the reconnaissance survey, a full survey

will be conducted based in part on data gathered in the reconnaissance survey. These results shall be coordination with the SHPO office, the Corps, and the pertinent tribal representatives of Florida for review and approval prior to tilling.

5. Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date.

6. Reduction and/or elimination of turbid water conditions in adjacent water bodies and wetlands are to be achieved through the use of silt curtains or screens in the construction area during periods of fill placement.

7. The permittee shall adhere to the Standard Protection Measures for the Eastern Indigo Snake dated February 2004.

8. The permittee shall abide by the *Tilling Practices for Phosphorus, Sediment and Vegetation Management in Lake Okeechobee* and the *Monitoring Plan for the Tilling Practices for Phosphorus, Sediment and Vegetation Management in Lake Okeechobee, Phase 1- Demonstration at Indian Prairie Parcel*.

9. The permittee shall not place any structure or equipment in a manner that would cause a navigation hazard.

This letter of authorization does not obviate the necessity to obtain any other Federal, State, or local permits, which may be required. In Florida, projects qualifying for this NWP must be authorized under Part IV of Chapter 373 by the Department of Environmental Protection, a water management district under §. 373.069, F.S., or a local government with delegated authority under §. 373.441, F.S., and receive Water Quality Certification (WQC) and Coastal Zone Consistency Concurrence (CZCC) (or a waiver), as well as any authorizations required by the State for the use of sovereignty submerged lands. You should check State-permitting requirements with the Florida Department of Environmental Protection or the appropriate water management district. In addition, the permittee is responsible for meeting the terms and conditions of the Grant Agreement between the SFWMD and the Department of the Interior.

This letter does not give absolute Federal authority to perform the work as specified on your application. The proposed work may be subject to local building restrictions mandated by the National Flood Insurance Program. You should contact your local office that issues building permits to determine if your site is located in a flood-prone area, and if you must comply with the local building requirements mandated by the National Flood Insurance Program.

If you are unable to access the internet or require a hardcopy of any of the conditions, limitations, or expiration date for the above referenced NWP, please contact Alisa Zarbo by telephone at 772-219-8418.

Thank you for your cooperation with our permit program. The Corps Jacksonville District Regulatory Division is committed to improving service to our customers. We strive to perform our duty in a friendly and timely manner while working to preserve our environment. We invite you to take a few minutes to visit the following link and complete our automated Customer Service Survey: http://regulatory.usacesurvey.com/. Your input is appreciated - favorable or otherwise.

Sincerely,

Jon Griffin
Program Manager

Enclosures

bcc:
CESAJ-RD-PE

GENERAL CONDITIONS
33 CFR PART 320-330
PUBLISHED FEDERAL REGISTER DATED 13 NOVEMBER 1986

1. The time limit for completing the work authorized ends on **date identified in the letter**. If you find that you need more time to complete the authorized activity, submit your request for a time extension to this office for consideration at least one month before the above date is reached.

2. You must maintain the activity authorized by this permit in good condition and in conformance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party in compliance with General Condition 4 below. Should you wish to cease to maintain the authorized activity or should you desire to abandon it without a good faith transfer, you must obtain a modification of this permit from this office, which may require restoration of the area.

3. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of what you have found. We will initiate the Federal and state coordination required to determine if the remains warrant a recovery effort of if the site is eligible for listing in the National Register of Historic Places.

4. If you sell the property associated with this permit you must obtain the signature of the new owner in the space provided and forward a copy of the permit to this office to validate the transfer of this authorization.

5. If a conditioned water quality certification has been issued for your project, you must comply with the conditions specified in the certification as special conditions to this permit. For your convenience, a copy of the certification is attached if it contains such conditions.

6. You must allow a representative from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished in accordance with the terms and conditions of your permit.

SELF-CERTIFICATION STATEMENT OF COMPLIANCE

Permit Number: NW-27
Application Number: SAJ-2008-134

Permittee's Name & Address (please print or type): _____

_____

_____

Telephone Number: _____

Location of the Work: _____

_____

Date Work Started: _____ Date Work Completed: _____

Description of the Work (e.g., bank stabilization, residential or commercial filling, docks, dredging, etc.): _____

_____

_____

Acreage or Square Feet of Impacts to Waters of the United States: _____

Describe Mitigation completed (if applicable): _____

_____

_____

Describe any Deviations from Permit (attach drawing(s) depicting the deviations): _____

_____

_____

****

I certify that all work, and mitigation (if applicable) was done in accordance with the limitations and conditions as described in the permit. Any deviations as described above are depicted on the attached drawing(s).

_____
Signature of Permittee

_____
Date

DEPARTMENT OF THE ARMY PERMIT TRANSFER REQUEST

PERMIT NUMBER: _____

When the structures or work authorized by this permit are still in existence at the time the property is transferred, the terms and conditions of this permit will continue to be binding on the new owner(s) of the property. Although the construction period for works authorized by Department of the Army permits is finite, the permit itself, with its limitations, does not expire.

To validate the transfer of this permit and the associated responsibilities associated with compliance with its terms and conditions, have the transferee sign and date below and mail to the U.S. Army Corps of Engineers, Enforcement Section, Post Office Box 4970, Jacksonville, FL 32232-0019.

_____
(TRANSFEREE-SIGNATURE)

_____
(DATE)

_____
(NAME-PRINTED)

_____

_____
(MAILING ADDRESS)

_____
(CITY, STATE, ZIP CODE)

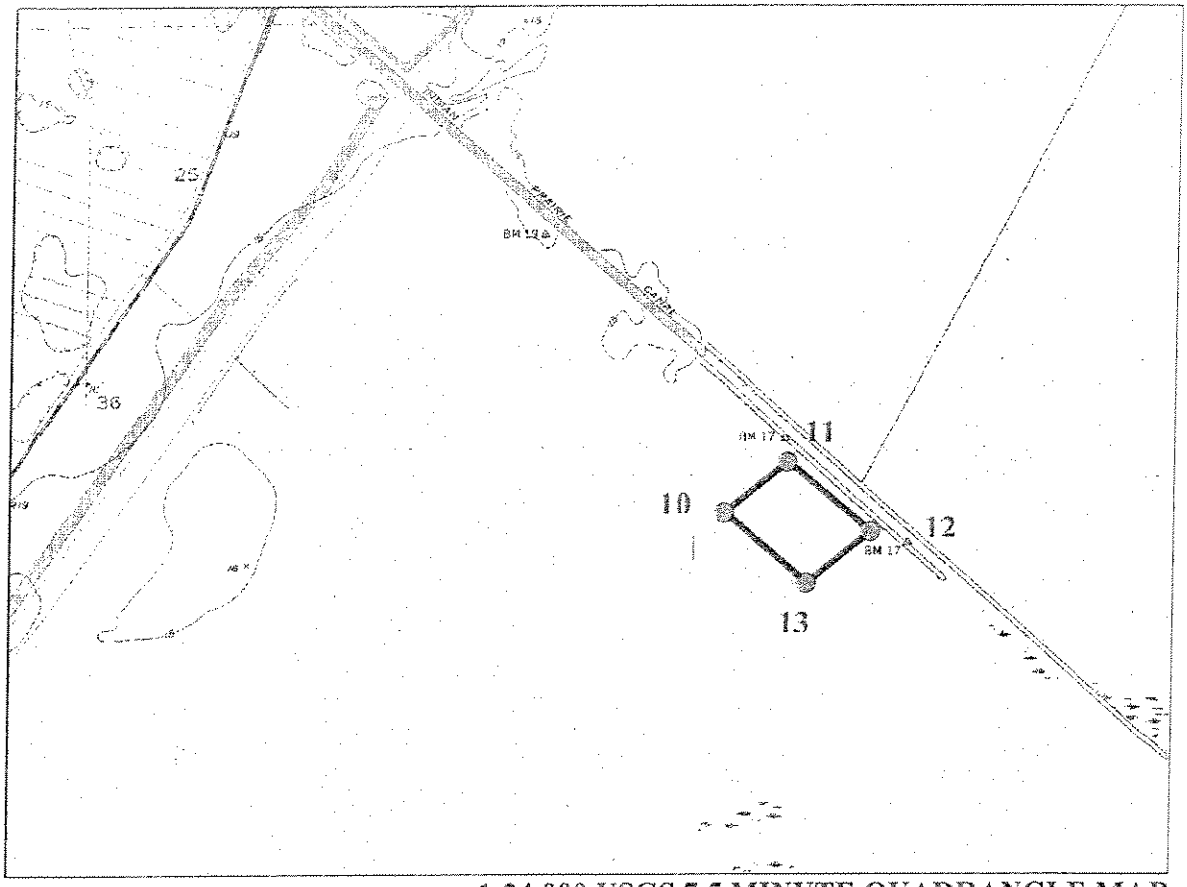
_____
(SUBDIVISION)

_____ _____
(LOT) (BLOCK)

_____
(STREET ADDRESS)

Attachment 1: Project Location Map

Tillage Practices for Phosphorus, Sediment and Vegetation Management in Lake Okeechobee, Phase I -- Demonstration at Indian Prairie parcel



1:24,000 USGS 7.5 MINUTE QUADRANGLE MAP
QUAD_NAME: Okeechobee SW
QUAD_NUM: 2508

Description	Label	Latitude	Longitude
Indian Prairie	10	27.045613	-80.953687
Indian Prairie	11	27.043439	-80.956734
Indian Prairie	12	27.042621	-80.949679
Indian Prairie	13	27.040361	-80.952733

Figure 1: Project Location

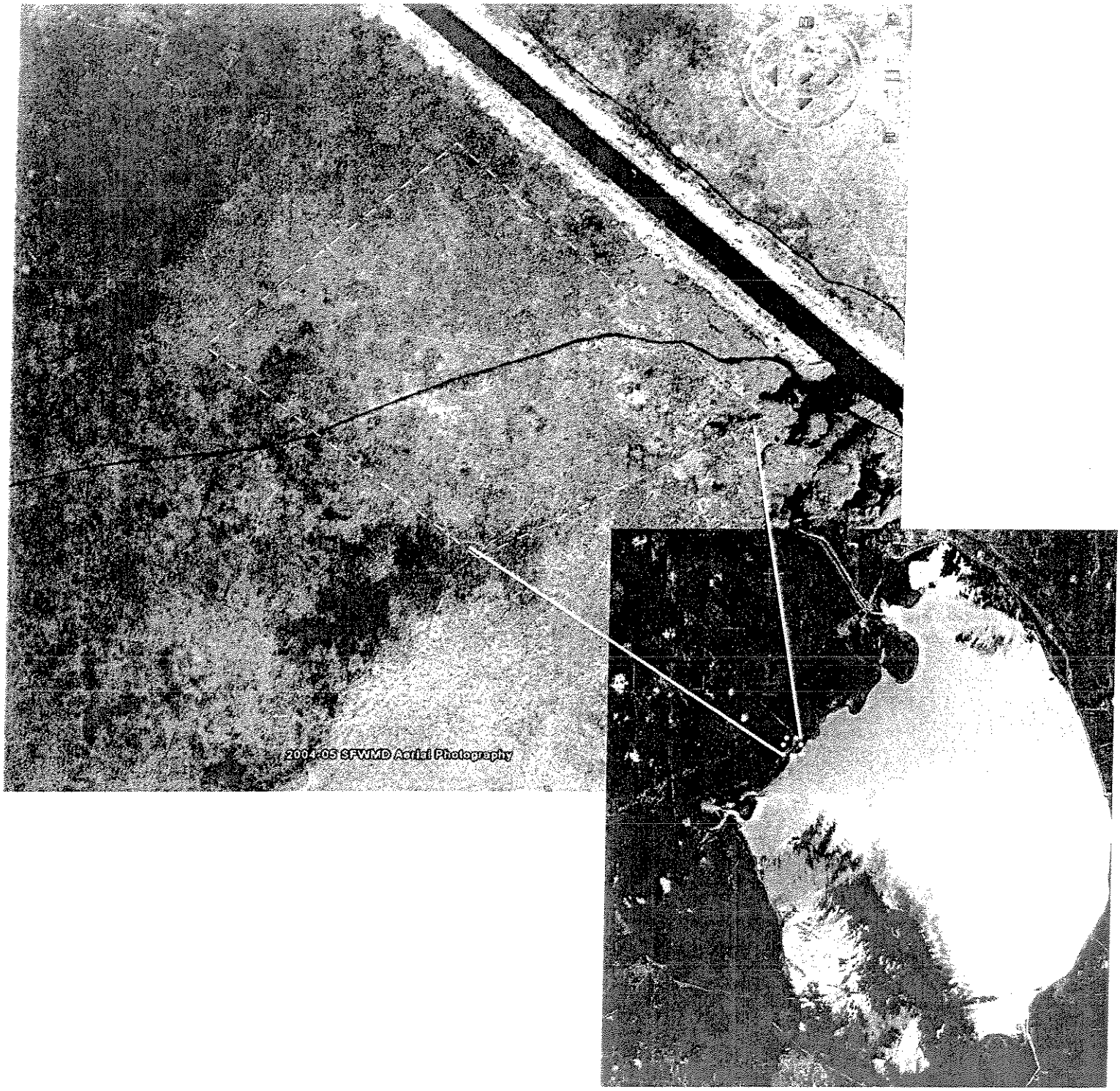
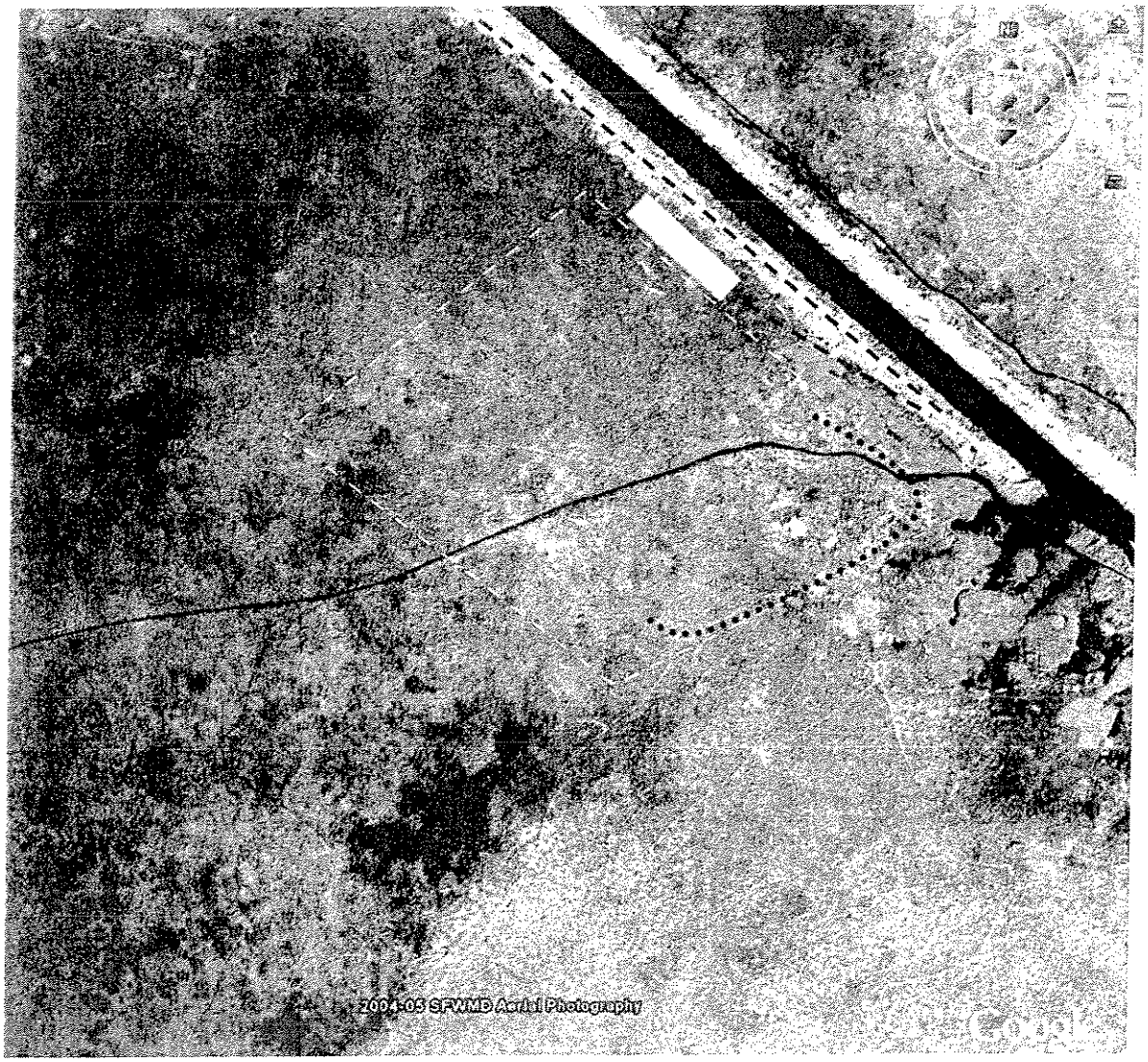


Figure 2: Aerial Photo

This project is located along the Northwest Marsh of Lake Okeechobee. The site can be accessed from SR 78. A District locked gate located at the south entrance of the Indian Prairie Cannel shall act as the site entrance for the project. Approximately 2.3 mile east of SR 78 along the canal levee shall be the construction route for all vehicles and equipment entering and leaving the site.



Access Road – – – – – Turbidly Barrier .....

Staging Area

Figure 3: Constructing Site

Attachment 2: Scope of Work

Tillage Practices for Phosphorus, Sediment and Vegetation Management in Lake Okeechobee

Prepared for
South Florida Water Management District
West Palm Beach, Florida

Prepared by
Water and Soil Solutions, LLC
Cocoa, Florida

January 4, 2008

Introduction

The South Florida Water Management District (SFWMD) faces the challenge of improving water quality throughout central and southern Florida, a region that contains ecologically significant estuaries, fresh water lakes and wetlands. Due to low water levels in Lake Okeechobee, there currently exists the opportunity to implement management practices within the lake to help sequester sediment nutrients, improve soil substrates and to enhance desirable wetland vegetation in this massive water body. This scope of work describes an approach for reducing internal nutrient loading and enhancing wetland plant habitat in Lake Okeechobee.

Rationale

Lake Okeechobee has vast near-shore and littoral regions dominated by wetland vegetation that have been exposed and dried down as a result of the low lake stages. Some of these areas have been invaded by terrestrial and undesirable wetland vegetation, which are utilizing nutrients stored in surficial sediments to support their standing crop biomass expansion. Other areas have thick deposits of muck soils resulting from the long-term accumulation of wetland and aquatic plant detrital materials. Once lake levels rise during the next prolonged wet period, the nutrients entrained in the dried-out sediments, and associated with vegetation biomass, almost certainly will be released to the water column following rehydration of the near-shore and littoral zones.

On the western side of Lake Okeechobee, the SFWMD and the Florida Fish & Wildlife Conservation Commission recently initiated efforts to excavate and haul enriched surficial sediments from selected locations. Sediment removal, however, is extremely expensive to perform at a large scale, particularly if haul distances are great.

Background Information on Tilling for Sequestering Phosphorus

The authors of this scope initiated research six years ago on tilling as a technique for sequestering nutrients associated with wetland plant biomass and detritus. In an initial study, we stocked six mesocosms with muck soils in March 2002 and flooded them with south Florida canal waters. The mesocosms were covered with an opaque shade structure to block sunlight, thereby inhibiting-macrophyte or algae growth in the water column. In early April, the mesocosms were drained and the soils were dried out for two weeks, and were then rehydrated under flowing water conditions until June. This dry-out and rehydration pattern was repeated again for two more cycles.

The muck proved to be relatively inert to drying and rewetting, and therefore did not release substantial P during the three rehydration periods (Figure 1). In a second treatment, at the start of the each dry out period, we placed live water hyacinth plants on the surface of the muck. The vegetation subsequently died and dried out, and released

substantial amounts of P to the water column upon rehydration. In a third treatment, we placed live water hyacinths on the muck surface at the beginning of the dry down period, and then subsequently tilled the dried plants into the shallow soils immediately prior to mesocosm rehydration. This tilling markedly curtailed P release to the open water column compared to the treatment in which the dead vegetation remained on the soil surface (Figure 1). We subsequently applied for a patent in February 2003 on the sequestration of pollutants using this technique, and the patent (7,074,330 B1) was awarded July 2006.

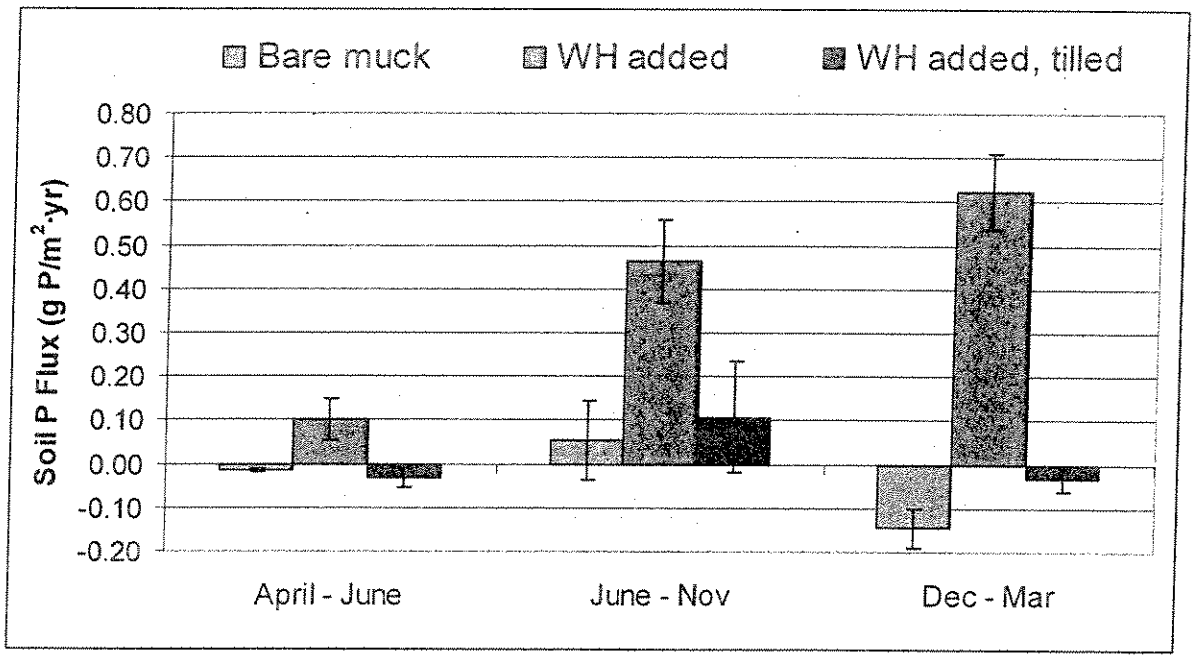


Figure 1. The above data are from a 2002 study, and represent three dry out and rehydration cycles for duplicate mesocosms operated under three treatment regimes: 1) mesocosms containing only bare muck; 2) mesocosms in which live water hyacinths were placed on the muck surface at the start of each dry out period. These plants died and dried out prior to reflooding; and 3) mesocosms in which live water hyacinths were placed on the muck surface at the start of each dry out period, and the dried plants subsequently were tilled into the shallow soils prior to rehydration. Positive values reflect sediment P export (flux) to the water during the rehydration period, and negative values represent P removal from the water.

Another assessment of the effectiveness of tilling for sequestering P in wetlands was performed in 2007. During that year, the SFWMD conducted an extensive retrofit of the eastern and western flow paths of STA-1W. As part of this effort, P-enriched surficial soils were excavated from much of Cell 1b. In a smaller region of this Cell, the surficial sediments were not removed, but instead were tilled beneath the subsurface soils. Following these soil management efforts, we performed an assessment for the SFWMD STA Research Division to compare the relative effectiveness of tilling and excavation of surface soils for sequestering P in the wetland soils. We collected duplicate, intact sediment cores from adjacent regions of Cell 1b that had been tilled and excavated. We also collected soils from a "control" site where no sediment management activity was

performed. The cores were transported to the laboratory, and were then reflooded with low-P waters collected from the outflow of STA-2. Soluble reactive P release from the sediments to the water column was measured over a 21 day period, after which time the cores were drained and again reflooded with low-P water. Soluble reactive P release was assessed over three 21-day batch cycles. Day 21 SRP concentrations in the control cores were high, at 1200, 1100 and 900 μg/L for the first, second and third cycles. By contrast, SRP release to the water column was much lower for the cores from which surficial sediments were excavated, and lower still for the tilled sediment cores (Figure 2). These data support the previous findings regarding the apparent P sequestration benefits of tilling in wetland parcels dominated by emergent vegetation.

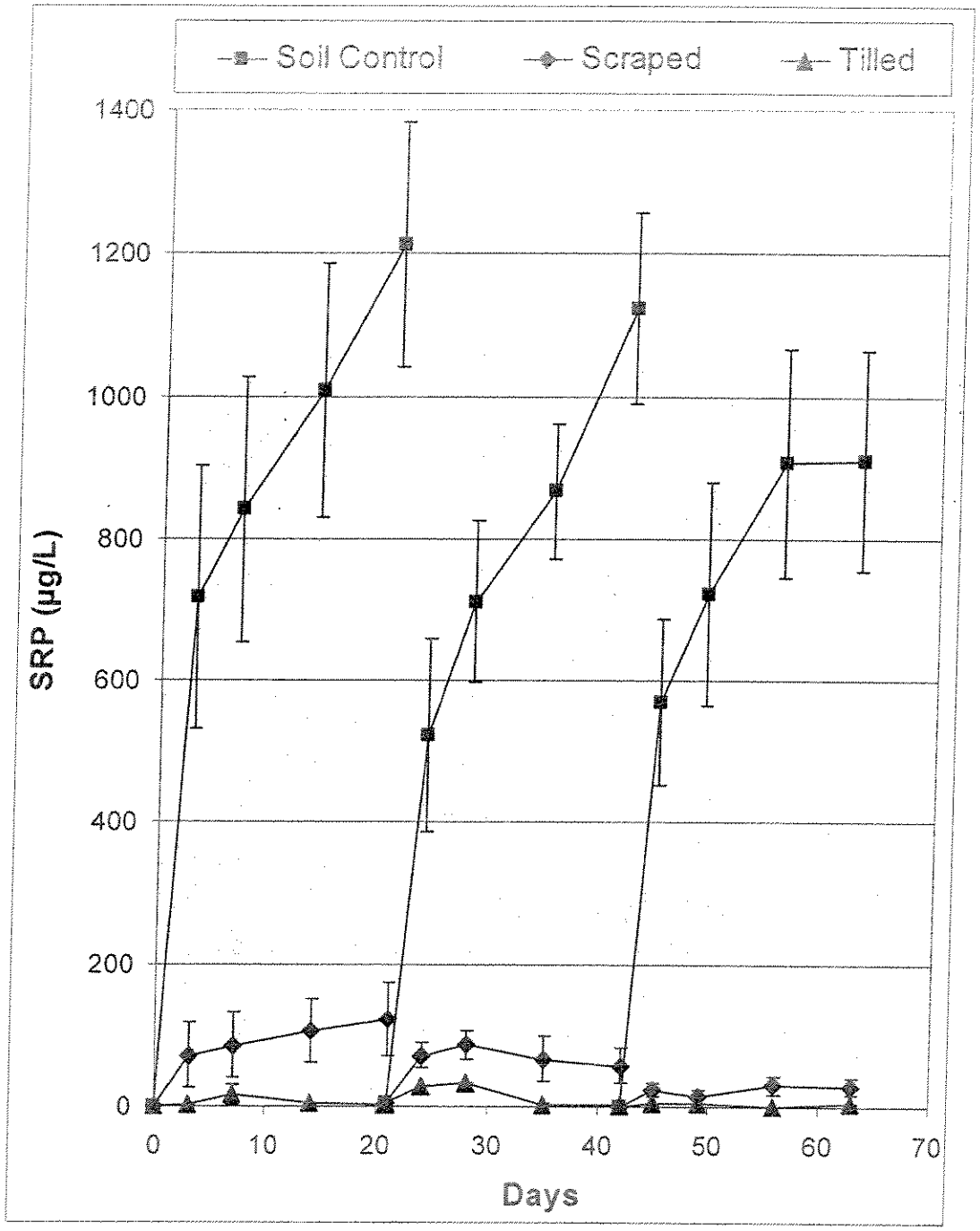


Figure 2. Soluble reactive P release during laboratory incubation of soil cores collected from tilled, excavated (scraped) and control regions of STA-1W Cell 1b. Values represent water column P levels during three 21-day batch incubations, starting at day 0, 21 and 42. The cores were flooded on those dates with low SRP waters obtained from the outflow of STA-2.

Potential Benefits of Tilling in Lake Okeechobee

Tilling (burial) of enriched surficial sediments could have the following benefits for Lake Okeechobee, depending upon site-specific conditions:

1. Reduction in surficial soil total P levels;
2. Reduction in the internal P loading from the sediments to the water column;
3. Replacement and/or reduction of undesirable organic sediments with more desirable soils, resulting in substrates with improved chemical and/or physical characteristics for supporting vegetation growth.

The purpose of our effort will be to determine whether soil/sediment/vegetation tilling as described in patent 7,074,330 B1 is a technically feasible and economically attractive approach for dealing with enriched organic materials (plants and/or sediments) that have accumulated within the lake. Tilling will be performed in a manner to bury P-enriched soil layers and residual wetland plant material.

The SFMWD and Florida Fish and Game Commission sponsored excavation of surficial muck soils at several sites during spring 2007, including one near Harney Pond on the western shore of Lake Okeechobee. At this location, there exists a ~50 acre "unexcavated" site immediately to the southeast of a previously excavated parcel. A second potential site, also approximately 50 acres in area, is located to the west of Indian Prairie Canal. In December 2007, we conducted several surveillance trips to identify the soils and vegetation at these sites. Both sites seem to be suitable candidates for tilling. Locations of these parcels are shown in Figure 3.

Our initial investigations of soils at the Harney Pond site suggest that tilling will require considerable upfront investigation of surface vegetation and subsurface conditions to define the appropriate tilling technique and depths. For example, the soil profile at Harney Pond consists of a surface layer of previously burned muck, underlain by a layer of sand (Figure 4). Our test holes on the 50-acre site indicate that this sand layer may vary in thickness from 0.5 to 1.0'. Another layer of muck lies underneath the sand layer (Figure 4). Therefore, in order to prevent exposure of the deep muck, tilling depths will need to be carefully evaluated and controlled.

The type of vegetation present also will influence the approach utilized for tilling. Extremely dense vegetation may need to be burned prior to tilling. Less dense parcels of vegetation likely will need to be mowed and disked prior to tilling. Regardless of the vegetation management regime, it is important to quantify the standing crop biomass and P content of the vegetation prior to tilling, since this material will be buried, along with the surficial soils, during the tilling process.

Additionally, due to potential variations in soil types with depth, it is important to conduct analyses for several key parameters on each soil layer prior to tilling to ensure that the soil layer ultimately placed on top is relatively inert with respect to P release, and that concentrations of potentially undesirable constituents are no greater than those found in existing surficial soils. At a relatively high density within the parcel, the soil profile should be characterized to a depth of 2 – 2.5'. Parameters that should be tested include: organic matter content, bulk density, total P, total N, arsenic, and labile (water-extractable and/or exchangeable) P. Each soil horizon should be sampled separately, or if no distinct horizination is present, at depth increments of 0-4, 4-12 and 12-24 inches.

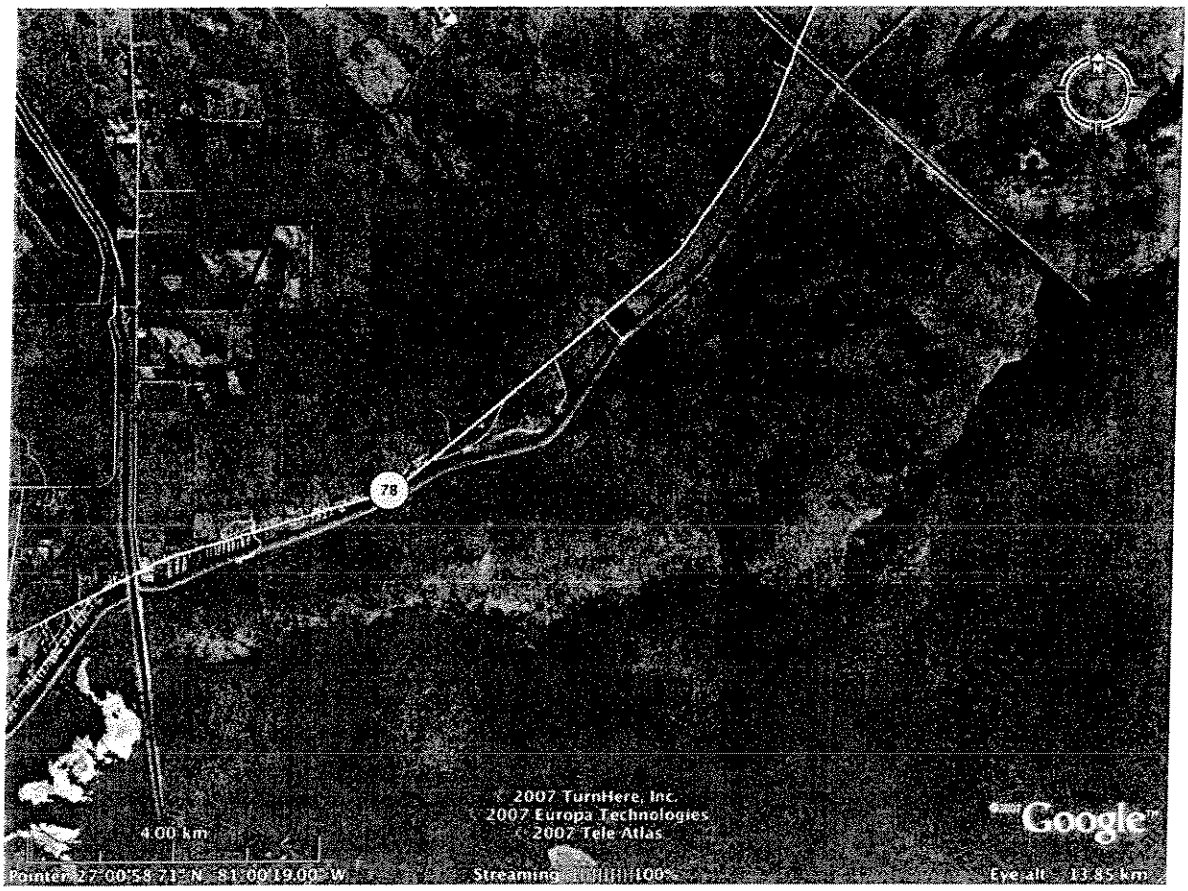


Figure 3. Red outlines depict the location of proposed Harney Pond (Site 2) (left) and Indian Prairie (Site 1) (right) tilling sites. One of these sites would be tilled during Phase One, and the second would be tilled under Phase Two.

Scope of Work

Implementation of the patented tilling technology in the lake will be performed in three phases:

Phase I. Tilling on a 50-acre demonstration site (Indian Prairie Site 1) under a *de minimus* permit; also, provide assistance to the SFWMD in obtaining the appropriate permits for a second 50-acre demonstration site.

Phase II. Tilling on a second 50-acre demonstration site (tentatively located at Harney Pond - Site 2);

Phase III. Identify large areas of the lake suitable for application of this technology; assist the SFWMD in obtaining the appropriate permits; and conduct large-scale tilling.

Phase I

We will perform tilling of enriched sediments and undesirable wetland plants at the Indian Prairie 50-acre site (Site 1) located in the lake's near-shore/littoral zone. It is assumed that the SFWMD will obtain a *de minimus* permit to work at this site. A *de minimus* permit would allow actual tilling for the first parcel to be performed within several weeks of the issuance of a Notice to Proceed. The time saved could be critical to being able to proceed with a large-scale effort in the spring. The SFWMD will collect and analyze the pre-/post sediments at this site for selected potentially toxic constituents, physical characteristics, nutrient content and seedbank studies. The results will be reported to the FDEP, and tilling will not proceed until final regulatory approval based on the results of the sediment analysis. This should eliminate the concern for causing environmental harm.

Under the Site 1 *de minimus* permit we will conduct the following activities:

1. Perform two to four tilling treatments (e.g., blending surficial soils with deeper soils at one or two depths and exchanging surficial soils with deeper soils at one or two depths), depending on soil profile characteristics, within the ~50-acre parcel;
2. Collect soil cores at a density of approximately one core/acre and visually record changes in the soil profile with depth. This information will be utilized to guide the mechanical tilling approach and depth. At a density of no more than one core per five acres, surficial and subsurface soils also will be analyzed. Vegetation standing crop also will be characterized using a quadrat sampling technique, at a density of no more than one quadrat per five acres. After tilling is performed, we will repeat the sampling, of surficial soils only, to define changes in the chemistry of site soils as a result of the soil management practices.
3. Assist SFWMD in the submittal of the permit application (with the SFWMD as the applicant) for the second 50-acre demonstration parcel (Indian Prairie Site 2).

For regulatory and scientific purposes, the SFWMD may also want to conduct additional investigations of the Phase 1 pilot effort. These include laboratory soil core incubations,

soil P and N fractionations, and vegetation seedbank studies. Our Phase 1 and 2 efforts will be conducted in such a way as to help accommodate these efforts. The above tests should confirm the effectiveness of various tilling approaches for mitigating soil P release upon reflooding. Additionally, they will provide an indication of the vegetation species that likely will recolonize the site, following the various soil management regimes. If this pilot-scale tilling effort proves successful, then a scale-up effort may later be undertaken within the lake under an additional scope.

Phase II

Phase II will entail tilling the second 50-acre demonstration parcel located at Harney Pond Site 2, along with associated soil and vegetation sampling. This effort would be started upon issuance of the appropriate permit(s) submitted as part of Phase I.

Phase III

Phase III will cover three main objectives as additional funding becomes available:

1. Survey large regions of the dry areas of the lake, taking widely dispersed cores (at a low sample density) to provide a low spatial resolution characterization of soil suitability for tilling. Factors to be characterized include thickness of organic layer, characteristics of subsoils, TP content of organic layer and characteristics of vegetation.
2. Assist the SFWMD in applying for a permit(s) for large-scale tilling, using the spatial sampling results as a guideline. It is anticipated that tilling will be conducted on 500 - 1000 acre (or other appropriate size) blocks at a time. Archaeological and threatened and endangered species work, along with higher resolution soil and vegetation sampling would be performed on parcels prior to the initiation of tilling. It is anticipated that high resolution spatial information on soil and vegetation characteristics will be required to guide and optimize tilling efforts, and to define the success of the tilling effort for sequestering P.
3. Conduct tilling on large-scale site(s).

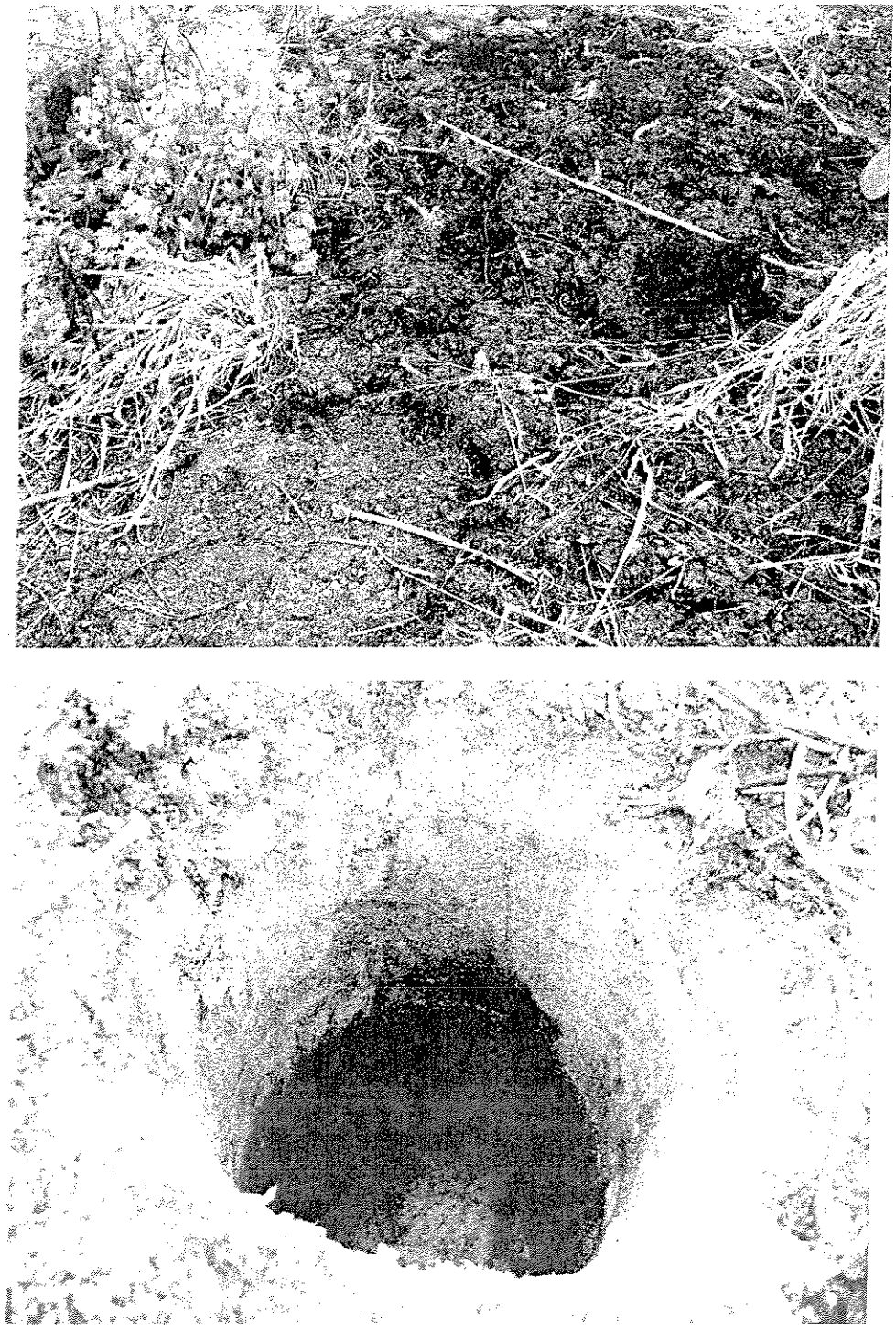


Figure 4. Previously burned, surficial organic soils at the proposed Harney Pond site taken December 2007 (top). Soil profile at the Harney Pond site, depicted the deep muck layer that underlies the ~ 0.5 - 1 ft thick sand layer (bottom). The surface organic soil has been pushed away from the hole for this photo.

Reporting

Letter progress reports, describing site activities and monitoring results for the two project sites, will be provided to the SFWMD as quickly as significant field or laboratory data become available. A final letter report will be provided at the end of each Phase.

Monitoring Plan
for
Tillage Practices for Phosphorus, Sediment and Vegetation Management in Lake Okeechobee, Phase I -- Demonstration at Indian Prairie Parcel

This initial pilot-scale test will evaluate four muck-tilling methods including plowing ("muck flipping") to shallow and deeper depths and disking ("muck blending") at these same two depths. These treatments will be compared to assess their effectiveness in: (1) reducing soil P concentrations; (2) reducing P flux to the overlying water column; and (3) creating soil conditions that are conducive to the establishment of desirable aquatic vegetation once the area is reflooded.

Eight plots of approximately equal size will be delineated for treatment within the 50-acre parcel. The following 4 treatments will be assigned to these plots to obtain 2 replicate plots for each treatment: (1) shallow plowing; (2) deep plowing; (3) shallow disking; and (4) deep disking. Actual depths for the shallow and deep tilling treatments will be determined based on an initial assessment of the soil profile (see below).

Pre-treatment Sampling and Testing

Soil cores will be collected at a density of approximately one core/acre prior to treatment and visually record changes in the soil profile with depth. This information will be utilized to guide the mechanical tilling approach and depth. Three of these cores will be sectioned based on visible soil horizons (e.g., sand vs. muck layers) or into fixed depth increments of 0-10, 10-30, and 30-60 cm if no distinct horizonation is present. Sectioned material will be submitted to a contract laboratory to measure concentrations of nutrients and potential contaminants. The list of parameters to be measured is provided in Table 1.

Prior to treatment, triplicate (0-10 cm depth increment) soil cores will be collected within each of the 8 plots, sectioned into the 0-10 cm and 10-30 cm depth increments, and analyzed for total and extractable P, bulk density, and soil particle size distribution. An additional set of cores will be collected to measure soil P release. These P-release measurements will be performed by flooding the cores with low-P water and measuring changes in the P concentration of this water over a 7-day period. Surface (0-5 cm depth) soils will be collected from each plot to determine the viable seed bank present prior to treatment. These samples will be transported to a SFWMD research location and incubated under both saturated and flooded conditions to promote germination of wetland and submerged aquatic plant seeds. Pre-treatment vegetation community and standing crop also will be characterized using a quadrat sampling technique, at a density of no more than one quadrat per five acres.

Post-treatment Sampling and Testing

Soil and seed-bank measurements will be repeated in each plot following treatment to quantify effects of different tilling methods on soil P concentrations, the potential for soil P release, and the composition of the seed bank. Additional surficial (0-10 cm) cores will be collected from each plot and stored at 4°C pending receipt of chemical data from pre-treatment cores submitted for contaminant analysis. These cores will be analyzed for any

contaminants detected at environmentally relevant concentrations in the pre-treatment samples.

The above tests should confirm the effectiveness of various tilling approaches for mitigating soil P release upon reflooding. Additionally, they will provide an indication of the vegetation species that likely will recolonize the site following the various soil treatment methods. If this pilot-scale tilling effort proves successful, then a scale-up effort may later be undertaken within the lake under an additional scope.

Table 1: Contaminant and nutrient analyses to be performed on pre-treatment and (as required) post-treatment soils

Organochlorine pesticides
Organophosphorus pesticides
Chlorinated herbicides
Resource Conservation and Recovery Act (RCRA) metals
Mercury
Total Organic Carbon, Total N and Total P
Total Recoverable Petroleum Hydrocarbons
Bulk Density

Eastern Indigo Snake
Drymarchon corais couperi
(Holbrook)

The eastern indigo snake is a non-poisonous, federally protected snake and is also known as gopher snake, blue indigo snake or blue bull snake. The eastern indigo snake is state and federally protected. It may occur in any habitat traversed within the construction area. They may not be captured, harmed, harassed, wounded, hunted, etc. The U.S. Fish and Wildlife Service and the Florida Fish and Wildlife Conservation Commission need your cooperation to help protect this threatened species.

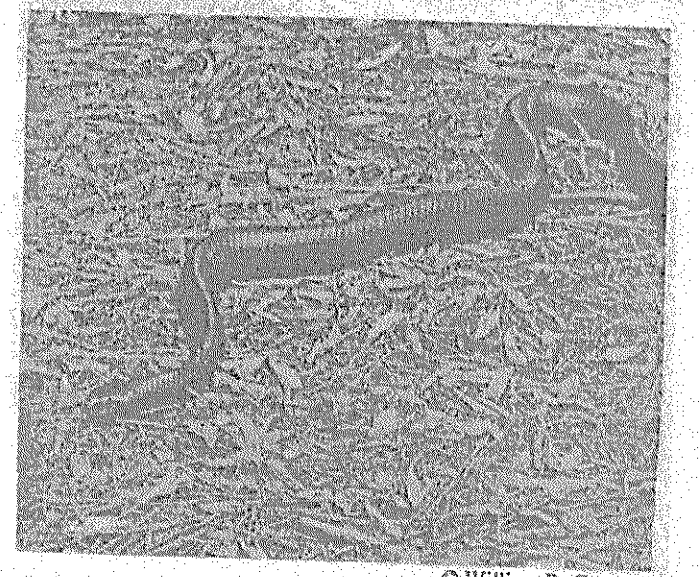
DESCRIPTION

The eastern indigo snake is shiny, blue-black in color with white, coral or rust reddish color around the chin, throat and cheeks. It is a thick-bodied snake that averages 6 feet in length and can grow to 8.6 feet. Young are similar to adults but some are lighter and show a blotched dorsal pattern.

LIFE HISTORY AND ECOLOGY

Within the construction area, the indigo snake is most likely to be found along the edges of swamps and marshes where food is abundant. This snake is also found in pine flatwoods and hardwoods communities. It feeds on fish, frogs, toads, birds, snakes, small turtles, birds, and small mammals. It is diurnal, i. e., active during the day. Eggs are laid in May or June (5-10 eggs), and hatchlings are 18-24 inches long. Hatchlings may appear as late as August and September. State law prohibits the "taking, attempting to take, pursuing, hunting, molesting, capturing or killing, possessing, transporting, or selling of this species or parts thereof or their nests or eggs" (Wildlife Code of the State of Florida, Chapter 39, F.A.C., Rule 39-27:002). Similarly, federal law prohibits "harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing or collecting, or attempting to engage in any such conduct (collectively defined as taking); or possessing, selling, delivering, carrying, transporting, or shipping protected species" [Endangered Species Act of 1973, as amended, 16. U.S.C. 1531(a)].

If You Should See an Eastern Indigo Snake...



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If the snake is observed, do not disturb it. Any disturbance of this snake's activity is prohibited. If an eastern indigo snake is sighted, construction shall cease and a qualified biologist at Kevin L. Erwin Consulting Ecologist, Inc. will immediately be contacted (see Kevin L. Erwin Consulting Ecologist, Inc. address and phone number). The eastern indigo snake will be allowed sufficient time to move away from the site or be relocated by a qualified biologist before construction or clearing is resumed. Only a qualified biologist will be permitted to come in contact with the eastern indigo snake. Construction can resume after the eastern indigo snake has moved from the area or has been relocated.

Please report any sighting of this snake. If a dead eastern indigo snake is found, the specimen should be thoroughly soaked in water, frozen immediately and the South Florida Ecosystem office contacted within 24 hours at (561) 562-3909. Sightings of eastern indigo snakes should be reported immediately to the following:

Additional Information

Jay Slack
South Florida Ecosystem Office
U. S. Fish and Wildlife Service
1339 20th Street
Vero Beach, Florida 32960
(561) 562-3909

William R. Cox
Kevin L. Erwin Consulting Ecologist, Inc.
2077 Bayside Parkway
Fort Myers, Florida 33901
(941) 337-1505

James Beever
Florida Fish and Wildlife Conservation Commission
Office of Environmental Services
29200 Tuckers Grade
Punta Gorda, Florida 33955
(941) 575-5765

References

Ashton, R. E., Jr. and P. S. Ashton. 1988. Handbook of Reptiles and Amphibians of Florida, Part One, The Snakes. Windward Publishing, Inc., Miami, Florida.

Logan, T.H. 1997. Florida's Endangered Species, Threatened Species, and Species of Special Concern. Florida Game and Fresh Water Fish Commission, Tallahassee, FL

Moler, P. E. 1992. Rare and Endangered Biota of Florida, Amphibians and Reptiles. Volume III. University Press of Florida, Tallahassee, Florida.

Smith, H. M. and E. D. Brodie, Jr. 1982. A Guide to Field Identification; Reptiles of North America. Golden Press, New York.